

We claim:

1. An enzyme system comprising:  
a porous matrix material having a pore volume wherein at least 90% of the pore volume is composed of pores having sizes in the range of 50 to 400 Å, and  
further comprising an enzyme bonded to the matrix material, wherein said enzyme occupies between 5 and 40% of the average pore volume, wherein the enzyme system comprises at least 8 mg of said enzyme per gram of matrix material and wherein said enzyme in the enzyme system exhibits an activity that is at least 65% of the enzyme's activity outside the matrix when activity of the enzyme inside the matrix and outside the matrix is measured under otherwise identical conditions including the same buffer conditions and same temperature, and expressed in unit activity per mass of enzyme.
2. The system of claim 1 wherein the enzyme system comprises 8 to 125 mg of said enzyme per gram of matrix material and wherein at least 90% of the pore volume is composed of pores having sizes in the range of 100 to 200 Å.
3. The system of claim 1 wherein said enzyme is organohydrolase (OPH).
4. The system of claim 1 wherein the enzyme has a volume in the range of  $0.5 \times 10^5 \text{ \AA}^3$  to  $3 \times 10^5 \text{ \AA}^3$ .
5. The system of claim 4 wherein the volume of the enzyme is in the range of 10 to 25% of the average pore volume.
6. The system of claim 4 wherein the surface area of the porous matrix material is at least 700 m<sup>2</sup>/g.
7. The system of claim 3 wherein said system comprises between 5 and 25 mg OPH per cubic centimeter.
8. The system of claim 3 wherein the OPH has a  $V_{max}$  of 0.15 to 0.66 AU/s.
9. The system of claim 3 wherein the system retains about 10% of its activity after 24 hours in 1M Tris at 12.0 pH.
10. The system of claim 1 wherein the matrix is a self-assembled monolayer on mesoporous silica (SAMMS).
11. The enzyme system of claim 1 wherein at least 90% of the pore volume is composed of pores having sizes in the range of 100 to 120 Å.
12. The enzyme system of claim 1 wherein the enzyme is bonded to the porous matrix through 2 to 10 connecting moieties.
13. The enzyme system of claim 1 wherein the enzyme is bonded to the porous matrix through a moiety having a chain length of 2 to 20 atoms.
14. The enzyme system of claim 12 wherein the enzyme is bonded to the porous matrix through a moiety having a chain length of 2 to 20 atoms.
15. The enzyme system of claim 1 wherein the enzyme is bonded to the porous matrix through a moiety having a chain length of 4 to 10 atoms.
16. Filtration equipment comprising the system of claim 1.

17. A chemical process catalyzed by the system of claim 1, comprising:  
contacting a reactant with the system of claim 1 wherein the enzyme in the system of claim 1 catalyzes the conversion of the reactant to a product; and  
forming the product.
18. The process of claim 17 selected from the group consisting of hydrolysis, oxidation, hydrogenation, and proteolysis.
19. An enzyme system comprising:  
a porous matrix material having a pore volume wherein at least 90% of the pore volume is composed of pores having sizes in the range of 50 to 400 Å and  
further comprising an enzyme bonded to the matrix material, wherein said enzyme occupies between 5 and 40% of the average pore volume, wherein said enzyme is OPH having an activity of 60 to 95% of the enzyme's activity outside the matrix when activity of the enzyme inside the matrix and outside the matrix is measured under otherwise identical conditions including the same buffer conditions and same temperature, and expressed in unit activity per mass of enzyme.
20. An enzyme system comprising:  
a porous matrix material and an enzyme;  
wherein the porous matrix material has a pore volume wherein at least 90% of the pore volume is composed of pores having sizes in the range of 50 to 400 Å; and  
comprising at least 8 mg of enzyme per gram of matrix material and wherein said enzyme in the enzyme system exhibits an activity that is at least 65% of the enzyme's activity outside the matrix when activity of the enzyme inside the matrix and outside the matrix is measured under otherwise identical conditions including the same buffer conditions and same temperature, and expressed in unit activity per mass of enzyme.
21. The enzyme of claim 20 wherein said enzyme occupies between 5 and 40% of the average pore volume.
22. The enzyme system of claim 20 wherein said enzyme is organohydrolase (OPH).
23. The enzyme system of claim 20 wherein the matrix is a mesoporous oxide material.
24. The enzyme system of claim 20 wherein at least 90% of the pore volume is composed of pores having sizes in the range of 100 to 120 Å.
25. A chemical process catalyzed by the system of claim 16, comprising:  
contacting a reactant with the system of claim 20 wherein the enzyme in the system of claim 20 catalyzes the conversion of the reactant to a product; and  
forming the product.

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